Claims

We claim:

1) The method and materials to make polymer-based objects, including

a) The process, which is the combination of injection, measurable pressure and microwave energy.

b) The compositions used in this process and systems.

2) The use of said process and system in claim 1) to give high accuracy shape and hardening of polymers and polymer-containing composites.

3) The use of a hand-held microwave applicator to harden polymers and polymer-containing composites at the site of application (i.e., intra-oral, orthopedic).

4) The compositions of claim 1 wherein said polymer-based materials, which is suitable for denture base, including one component and two component denture base. Two kinds of denture base consist of monodi-, tri-, or multifunctional methacrylate polymers or monomers, cross-linking agent, organic pigments or metal oxides, plasticizers and initiators.

5) The composition of claim 4 wherein said mono-, di-, tri- or multifunctional methacrylate polymers is within the scope of the general formula:

$$\begin{array}{c}
R_2 \\
-\{CH_2-C\}_{\overline{n}} \\
C=O
\end{array}$$

$$\begin{array}{c}
R_1
\end{array}$$

The R_1 is hydrogen, alkyl, substituted alkyl group, cyclic hydrocarbon, benzyl, ether, hydroxyalkyl, R_2 is hydrogen, halogen, alkyl, substituted alkyl group and n is an integer at least equal to 2.

- 6) The composition of claim 1 wherein said polymer-based materials, which is suitable for soft denture and consists of organopolysiloxanes and phosphonitrilic fluoroelastomers.
- 7) The composition of claim 6 wherein said organopolysiloxanes is within the scope of the general formula:

$$R_2$$
 R_2 R_2 R_2 R_2 R_3 R_4 R_5 R_5 R_7 R_8 R_8 R_8 R_8 R_8 R_8 R_8

Wherein m is an integer having a value form 1 to about 6,000; n is an integer having a value form 1 to 6; R_1 is hydrogen or alkyl group, R_2 and R_3 are alkyl groups having 1 to 6 carbons.

8) The composition of claim 6 wherein said phosphonitrilic fluoroelastomers is within the scope of general

formula:

$$\begin{array}{c}
\text{OCH}_2(\text{CF}_2)_n X \\
\text{OCH}_2(\text{CF}_2)_n X
\end{array}$$
(VI)

wherein X is H or F, and n is usually from 1 to 11. and

$$\begin{array}{c|c}
 & \text{OCH}_2\text{CF}_3 \\
 & \text{OCH}_2(\text{CF}_2)_n\text{CHF}_2 \\
\end{array}$$
(VII)

wherein n is 3,5,7,9, or 11, and m is from 10,000 to 50,000.

- 9) The composition in claim 1 wherein said polymer-based materials, which is suitable for use as composite resins, comprised of a polymer matrix, fillers, initiator and coupling agent.
- 10) The composition in claim 9 wherein said polymer matrix is a polymerizable resin suitable for use in the oral environment, which includes 2,2-bis[4-(2-hydroxy-3-methacrylyloxpropoxy)phenyl]propane (BisGMA), ethylenehlycol dimethacrylate (EGDMA) and triethyleneglycol dimethacrylate (TEGDMA), cutectic monomers, hydrophobic monomers, urethane dimethacrylate resins, spiro orthocarbontes, organo-esters of phosphorus.
- 11) The composition in claim 9 wherein said fillers comprise (silica) calcium, strontium, lanthanum, barium, rare earth, alumina, silicate in crystalline, or in aluminosilicate with a zeolite structure, and fluoride of the rare earth metals or mixtures of such fluorides (glass pyrogenically produced, ceramics, zirconium, gold, silver, or silver-tin alloys.
- 12) The weight % of the organic filler, as an overall weight of the composite, being in the range of 30 to 96%, but preferably in the range of 50 to 85%.
- 13) The particle size of fillers in claim 11 ranging from 0.04 micrometers to approximately 10 micrometers, preferably being distributed between 1 and 7 micrometers.
- 14) The composition of claim 9 wherein said initiator comprises microwave sensitive compounds, which include but are not limited to benzoyl peroxide, dilauroyl peroxide, (tert-butyl peroctoate or tert-butyl perbenzoate, 2,4-dichorobenzoyl peroxide and 4,4—dechlorobenzoyl peroxide) in the weight range of the composition of 0.05% to 1.0 %, preferably in the range of 0.09 to 0.5%,
- 16) The composition in claim 9 wherein said accelerators include but are not limited to amine accelerators, comprising N, N-diethenol-p-toluidine, or triethylamine.
- 17) The composition in claim 9 wherein said couplers include but are not limited to polyfunctional agents, such as gamma-methoxypropylene silane.
- 18) The composition in claim 17 wherein said coupler contains an Si-O functionality and an ethylenically unsaturated group
- 19) The compostion in claim 9 wherein said couplers consist of thiomethacryulates.